

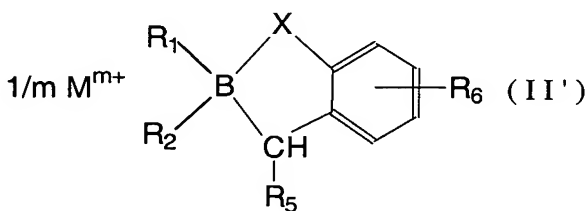
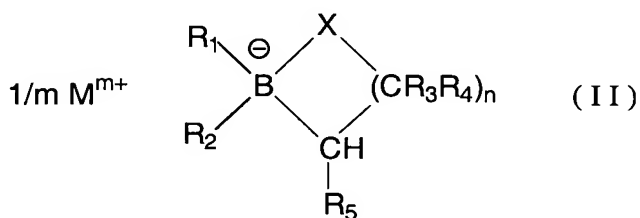
We Claim:

What is claimed is:

1. A method for adhesively bonding substrates, the method comprising the steps of:

(a) providing at least a first and a second substrate;
(b) applying a mixture to at least one of said first and said second substrates, said mixture comprising:

(i) at least one addition polymerizable component;
(ii) an effective amount of an internally blocked borate compound having a ring structure (I I) or (II')



wherein X represents $-\text{CHR}_7-$, oxygen or sulfur; n is the integer 1, 2, 3, 4, or 5, and R_1 , R_2 , R_3 , R_4 , R_5 , R_6 and R_7 are independently selected from unsubstituted and substituted alkyl or alkylene groups containing 1 to 10 carbon atoms, substituted aryl groups having up to 7 to 12 carbon atoms, and unsubstituted aryl groups; alternatively either of R_3 , R_4 , R_5 , R_6 and R_7 are hydrogen; R_1 and R_2 alternatively are part of a second unsubstituted or substituted cyclic borate;

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R_1 and R_2 alternatively comprise a spiro ring or a spiro-ether ring; R_1 or R_2 together with R_3 or R_4 alternatively are linked to form a cycloaliphatic ring; and R_1 or R_2 together with either R_3 or R_4 alternatively comprise a cyclic ether ring; and M is any positively charged species with charge m greater than 0 and

(iii) a deblocking agent;

(c) mating the first and second substrates with said mixture of step (b) therebetween; and

(d) allowing the at least one addition polymerizable component to polymerize, optionally with application of heat, whereby the first and second substrates are adhesively bonding.

2. The method according to claim 1 wherein one of said first and said second substrate comprises a material selected from the group consisting of a wood product, thermoplastic material, a thermoset material, and coated or uncoated metal.

3. The method according to claim 2 wherein one of said first and said second substrate comprise materials selected from the group consisting polyethylene, polypropylene, polyurethane, polyurea, fluoroplastic, polyvinylchloride, thermoset polymer, elastomer, aluminum, and steel.

4. The method according to claim 1 wherein said mixture further comprises (iv) an accelerator.

5. The method according to claim 1 wherein the at least one addition polymerizable component comprises a monofunctional methacrylate ester selected from the group consisting of methyl methacrylate, ethyl methacrylate, methoxy ethyl methacrylate, hydroxyethyl methacrylate, hydroxypropyl

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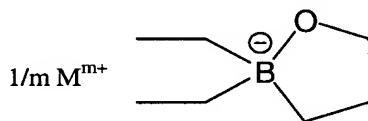
methacrylate, cyclohexyl methacrylate, tetrahydrofurfuryl methacrylate, and blends thereof.

6. The method according to claim 5 wherein the methacrylate ester monomer is tetrahydrofurfuryl methacrylate, and said addition polymerizable component further comprises an alkyl acrylate.

7. The method according to claim 1 wherein said mixture further comprises a thickening agent.

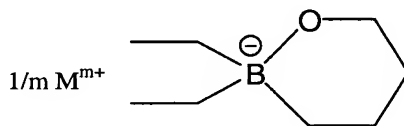
8. The method according to claim 1 wherein said mixture further comprises an elastomer.

9. The method according to claim 1 wherein the internally blocked organoborate has the structure:



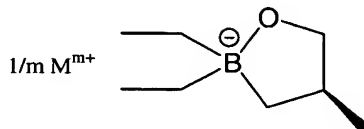
wherein M is a counter ion with charge m of +1, +2, or +3.

10. The method according to claim 1 wherein the internally blocked organoborate has the structure :



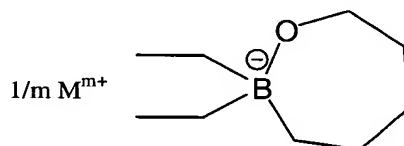
wherein M is a counter ion with charge m of +1, +2, or +3.

11. The method according to claim 1 wherein the internally blocked organoborate has the structure:



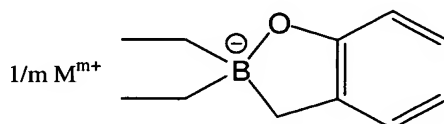
wherein M is a counter ion with charge m of +1, +2, or +3.

12. The method according to claim 1 wherein the internally blocked organoborate has the structure:



wherein M is a counter ion with charge m of +1, +2, or +3.

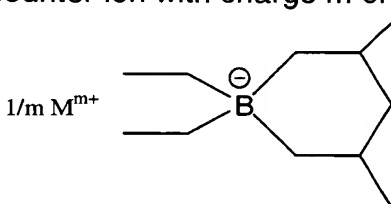
13. The method according to claim 1 wherein the internally blocked organoborate has the structure:



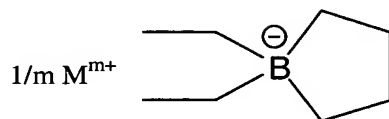
wherein M is a counter ion with charge m of +1, +2, or +3.

14. The method according to claim 1 wherein the internally blocked organoborate has the structure:

wherein M is a counter ion with charge m of +1, +2, or +3.

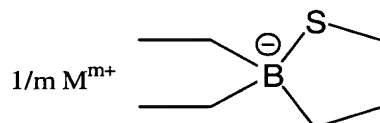


15. The method according to claim 1 wherein the internally blocked organoborate has the structure:



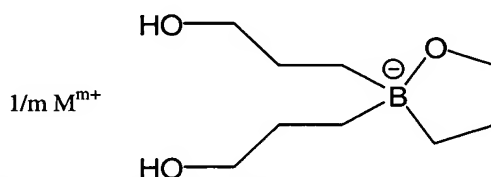
wherein M is a counter ion with charge m of +1, +2, or +3.

16. The method according to claim 1 wherein the internally blocked organoborate has the structure:



wherein M is a counter ion with charge m of +1, +2, or +3.

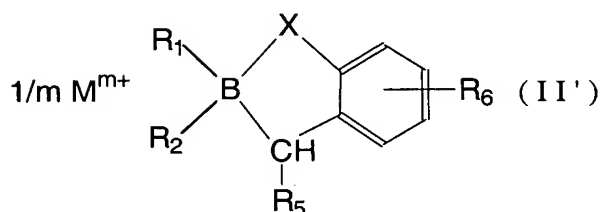
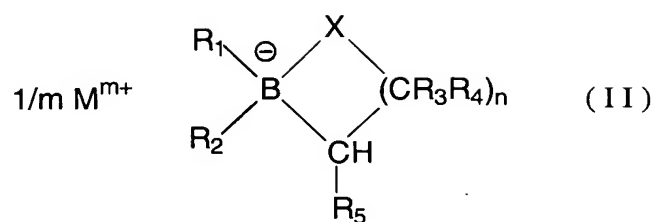
17. The method according to claim 1 wherein the internally blocked organoborate has the structure:



wherein M is a counter ion with charge m of +1, +2, or +3.

18. The method of claim 1 wherein said mixture further comprises a polymeric material.

19. A polymerizable composition comprising:
- a) at least one polymerizable monomer;
 - b) an internally blocked borate having the structure (I I) or (II')



wherein X represents $-\text{CHR}_7-$, oxygen or sulfur; n is the integer 1, 2, 3, 4, or 5, and $R_1, R_2, R_3, R_4, R_5, R_6$ and R_7 are independently selected from unsubstituted and substituted alkyl or alkylene groups containing 1 to 10 carbon atoms, substituted aryl groups having up to 7 to 12 carbon atoms, and unsubstituted aryl groups; alternatively either of R_3, R_4, R_5, R_6 and R_7 are hydrogen; R_1 and R_2 alternatively are part of a second unsubstituted or substituted cyclic borate; R_1 and R_2 alternatively comprise a spiro ring or a spiro-ether ring; R_1 or R_2 together with R_3 or R_4 alternatively are linked to form a cycloaliphatic ring; and R_1 or R_2 together with either R_3 or R_4 alternatively comprise a cyclic ether ring; and M is any positively charged species with charge m greater than 0; and

c) a compound that liberates an organoborane from said internally blocked borate.

20. A polymerizable composition according to claim 19 wherein the polymerizable monomer is selected from the group consisting of monofunctional substituted or unsubstituted acrylate ester, monofunctional substituted or

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unsubstituted methacrylate ester, and a mixture of said acrylate and said methacrylate ester.

21. A polymerizable composition according to claim 20 wherein the polymerizable monomer is a monofunctional methacrylate ester selected from the group consisting of methyl methacrylate, ethyl methacrylate, methoxy ethyl methacrylate, hydroxyethyl methacrylate, hydroxypropyl methacrylate, cyclohexyl methacrylate, tetrahydrofurfuryl methacrylate, and mixtures thereof.

22. A polymerizable composition according to claim 21 wherein the polymerizable monomer is tetrahydrofurfuryl methacrylate .

23. A polymerizable composition according to claim 20 further comprising an elastomeric modifier.

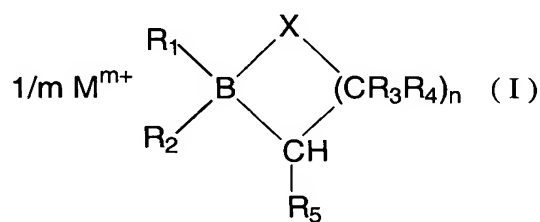
24. A polymerizable composition according to claim 19 wherein the composition comprises about 1.5 to 6 mol% of said internally blocked borate.

25. A polymerizable composition according to claim 19 contained in a two-chamber dispenser, wherein a) and b) are contained in one chamber of said dispenser and c) is contained in the other chamber of said dispenser as a solution or dispersion in a carrier liquid, said dispenser adapted to combine the parts upon dispensing of said composition.

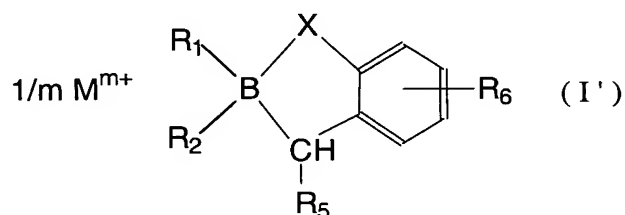
26. A polymerizable acrylic composition according to claim 25 wherein the two-part dispenser is adapted to combine the first part and the second part of the two-part adhesive composition in a volume ratio of the first part to the second part of from 10:1 to 1:1.

27. A polymerizable acrylic composition according to claim 25 wherein said second chamber contains c) in a dispersion in a non-solvent carrier for c).

28. A compound which has the structure:

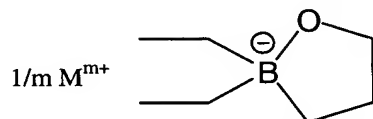


or



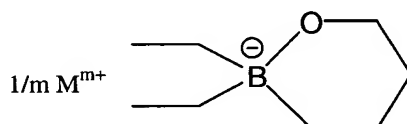
wherein for X is oxygen or sulfur; wherein when X represents oxygen, n is the integer 2, 3, 4, or 5; and wherein when X represents sulfur, n is the integer 1, 2, 3, 4 or 5; and R₁, R₂, R₃, R₄, R₅ and R₆ are, independently, unsubstituted and substituted alkyl groups containing 1 to 10 carbon atoms, alkylene groups containing 1 to 10 carbon atoms, substituted aryl groups containing 7 to 12 carbon atoms, or unsubstituted aryl groups; alternatively either of R₃, R₄, R₅ and R₆ in (I) include hydrogen; alternatively, R₁ and R₂ are part of a second unsubstituted or substituted cyclic borate; R₁ and R₂ alternatively comprise a spiro ring or a spiro-ether ring; alternatively, R₁ or R₂ together with R₃ or R₄ in (I) are linked to form a cycloaliphatic ring; alternatively in (I) R₁ or R₂ together with either R₃ or R₄ comprise a cyclic ether ring; and M is any positively charged species with m being greater than 0.

29. The compound of claim 28 having the structure:



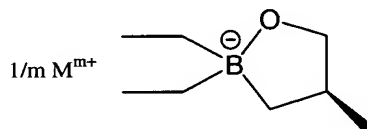
wherein M is a counter ion with charge m or +1, +2 or +3.

30. The compound of claim 28 having the structure:



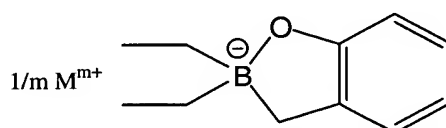
wherein M is a counter ion with charge m of +1, +2, or +3 .

31. The compound of claim 28 having the structure:



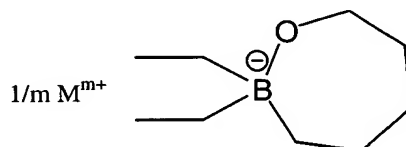
wherein M is a counter ion with charge m of +1, +2, or +3 .

32. The compound of claim 28 having the structure:



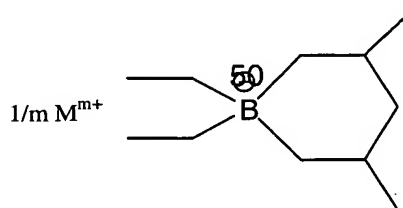
wherein M is a counter ion with charge m of +1, +2, or +3.

33. The compound of claim 28 having the structure:



wherein M is a counter ion with charge m of +1, +2, or +3.

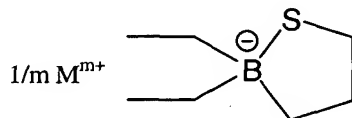
34. The compound of claim 28 having the structure:



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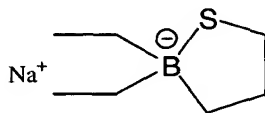
wherein M is a counter ion with charge m of +1, +2, or +3.

35. The compound of claim 28 having the structure:



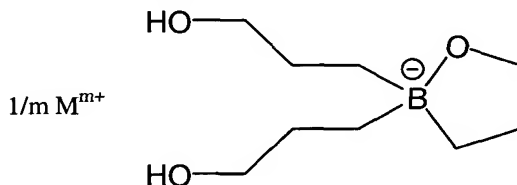
wherein M is a counter ion with charge m +1, +2, or +3.

36. The compound of claim 28 having the structure:



wherein M is a counter ion with charge m of +1, +2, or +3.

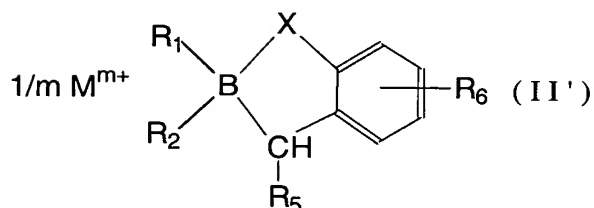
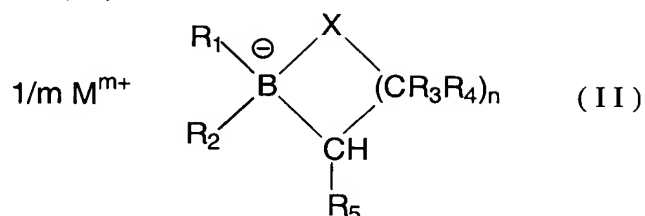
37. The compound of claim 28 having the structure:



wherein M is a counter ion with charge m +1, +2, or +3.

38. A bonded composite comprising a first substrate, a second substrate, and a cured composition that adhesively bonds the first and second substrates together, wherein the composition results from the curing a composition comprising:

- (a) at least one acrylic monomer;
- (b) an internally blocked borate compound having a ring structure (I I) or (II')



wherein X represents $-CHR_7-$, oxygen or sulfur; n is the integer 1, 2, 3, 4, or 5, and R_1 , R_2 , R_3 , R_4 , R_5 , R_6 and R_7 are independently selected from unsubstituted and substituted alkyl or alkylene groups containing 1 to 10 carbon atoms, substituted aryl groups having up to 7 to 12 carbon atoms, and unsubstituted aryl groups; alternatively either of R_3 , R_4 , R_5 , R_6 and R_7 are hydrogen; R_1 and R_2 alternatively are part of a second unsubstituted or substituted cyclic borate; R_1 and R_2 alternatively comprise a spiro ring or a spiro-ether ring; R_1 or R_2 together with R_3 or R_4 alternatively are linked to form a cycloaliphatic ring; and R_1 or R_2 together with either R_3 or R_4 alternatively comprise a cyclic ether ring; and M is any positively charged species with charge m greater than 0.

39. A bonded composite according to claim 38 wherein the one of said substrates is formed from a material that has a surface energy of less than 45 mJ/m².

40. A bonded composite according to claim 38 wherein the first substrate comprises a material selected from the group consisting of polyethylene, a polypropylene, a polyvinylchloride and a fluoroplastic.

41. A bonded composite according to claim 38 wherein both the first and second substrates are formed from a material having a surface energy of less than 45 mJ/m².

42. A bonded composite according to claim 38 wherein both the first and second substrates comprise materials independently selected from the group consisting of a polyethylene, a polypropylene, a polyvinylchloride and a fluoroplastic.

43. A bonded composite according to claim 38 wherein R₁ and R₂ are each independently selected from the group consisting of alkyl groups having 2 to 5 carbon atoms.